

Name: _____

Block: _____

Water balance in animals

Animals have physiological adaptations that allow them to maintain water balance. The example often given is the desert or kangaroo rat, which has dry mouth and nasal passages, long loops of Henle, high levels of **ADH** in its blood, an efficient large intestine and does not sweat. These adaptations allow the kangaroo rat to minimize water loss and maximize water reabsorption.

Animals may also demonstrate behavioral adaptations to limit water loss. The kangaroo rat will burrow underground where it is cooler during the day and is nocturnal – venturing out when conditions are cooler at night.

Osmoregulation in fish

Because of their environment, osmoregulation in fish presents specific problems. Fish have adaptations that enable them to deal with these problems. Those which live in fresh water or sea water have different problems.

Freshwater fish

Problems:

- These fish are *hypertonic* to their surroundings. This means their blood has a lower water concentration than the surrounding fresh water. So the solution the fish live in is *hypotonic*.
- As fresh water passes through the mouth and over the gill **membranes**, water **molecules** diffuse from the fresh water into the blood by osmosis.
- These fish must produce a very large volume of urine to balance this large intake of water.
- This large volume of urine carries salt with it, and the salt has to be replaced.

Solutions:

- To produce a large volume of urine the fish must remove a large volume of water from the blood by having a high rate of filtration into the **kidney** tubules.
- This is done by having a kidney with many large glomeruli - capillary networks from which fluid is filtered at the start of the kidney tubules.
- Salt replacement is solved by chloride secretory **cells** in the gills, which actively transport **salts** from the surrounding water into the blood.
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Saltwater fish

Problems:

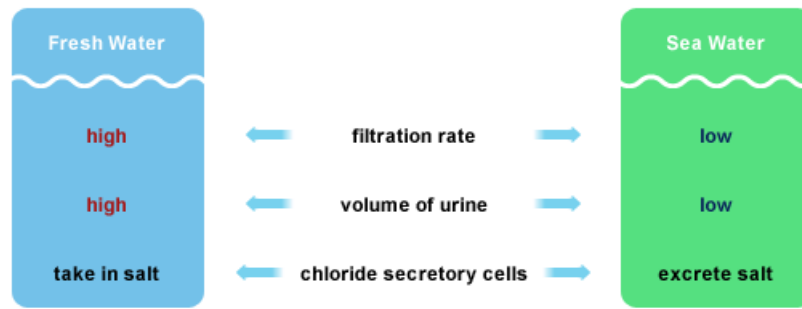
- These fish are *hypotonic* to their surroundings. This means their blood has a higher water concentration than the surrounding sea water.
- As sea water passes through the mouth and over the gill membranes, water molecules diffuse out of the blood into the sea water by osmosis.
- These fish must replace the water which they constantly lose by osmosis
- They can also only afford to produce a very small volume of urine.
- Drinking sea water brings a large quantity of salt into the blood and this has to be removed.

Solutions:

- To replace the water they lose, saltwater fish drink sea water.
- To produce a small a volume of urine they must have a low rate of filtration of water into the kidney tubules.
- This is done by having a kidney with relatively few small glomeruli.
- Salt is removed by chloride secretory cells in the gills, which actively transport salts from the blood into the surrounding water.

Osmoregulation in salmon

Salmon begin their lives in rivers and migrate to the sea, returning to the same rivers later in their lives. They are able to cope with these changes by altering the way they osmoregulate.



Answer the Following questions in complete sentences.

1. What is osmoregulation?
2. What type of solution do freshwater fish live in?
3. What type of solution do salt water fish live in?
4. Describe how freshwater fish regulate water in their bodies.
5. Describe how saltwater fish regulate water in their bodies.